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BULLETIN No. 10.

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U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF AGROSTOLOGY.

[Grass and Forage Plant Investigations.]

A REPORT

UPON THE

GRASSES AND FORAGE PLANTS

OF

CENTRAL TEXAS.

BY

H. L. BENTLEY,

Special Agent in Charge of Grass Experiments at Abilene, Tex.

PREPARED UNDER THE DIRECTION OF THE AGROSTOLOGIST.

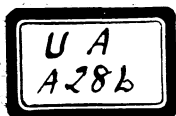


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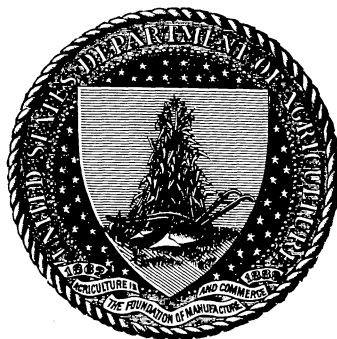
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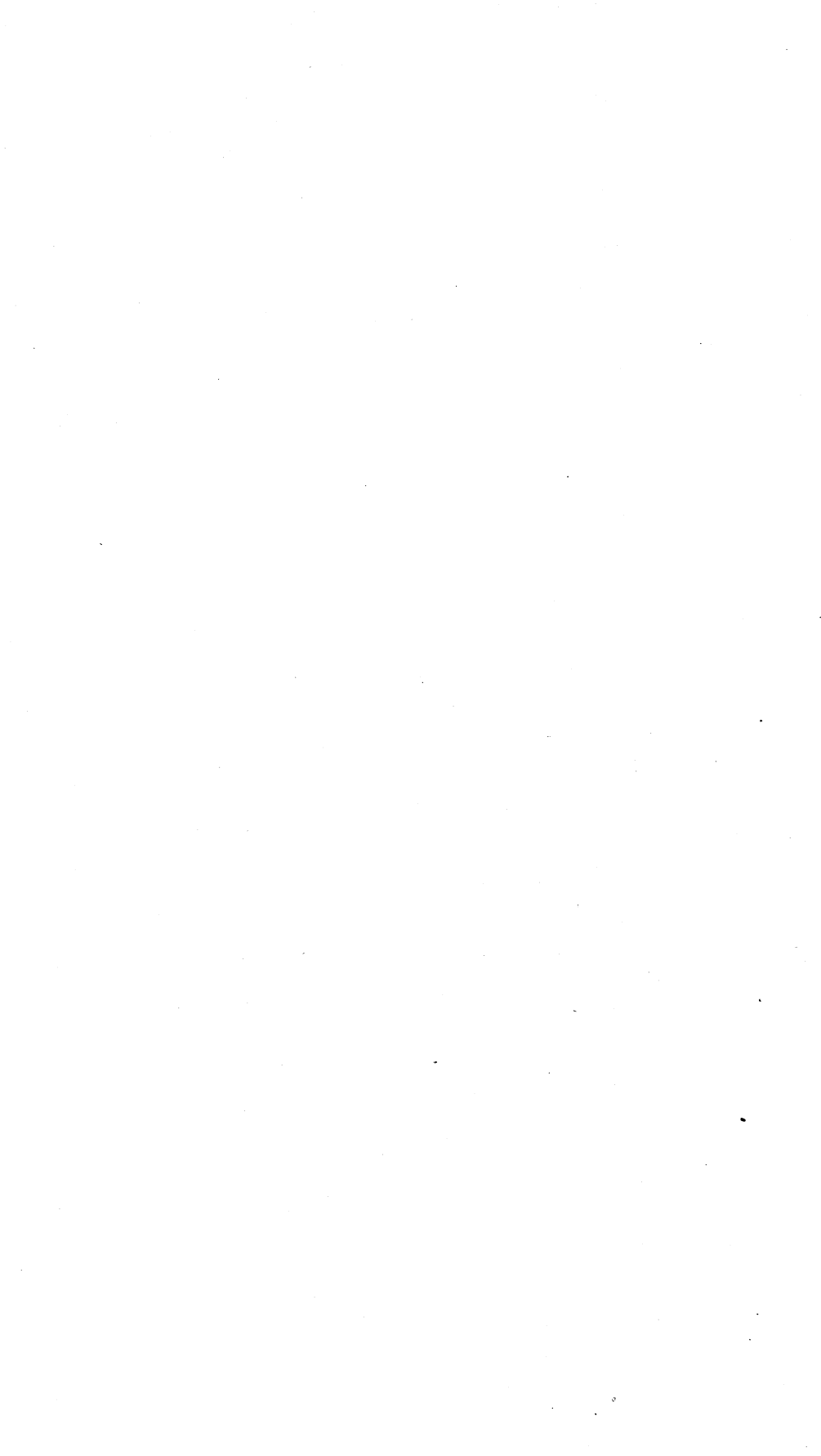
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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF AGROSTOLOGY,
Washington, D. C., March 3, 1898.

SIR: I have the honor to transmit herewith for publication, as Bulletin No. 10 of this division, a report by Mr. H. L. Bentley, special agent in the Division, upon the grasses and forage plants of central Texas. This report contains brief accounts of the physical character of central Texas; the early and present condition of the ranges; and popular descriptions, and general observations upon the distribution and economic importance of a large number of the grasses and forage plants native to the region. From this report stockmen and others will gain some idea of the extent and value of the natural forage resources of the country, and it will, without doubt, awaken an interest in the preservation and improvement of the forage supplies.

Respectfully,

F. LAMSON-SCRIBNER,
Agrostologist.

Hon. JAMES WILSON,
Secretary of Agriculture.

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A REPORT UPON THE GRASSES AND FORAGE PLANTS OF CENTRAL TEXAS.

THE CATTLE RANGES AND THEIR DETERIORATION.

PURPOSE OF REPORT.

The purpose of this report is to invite the attention of stockmen and farmers to the mistakes made in the past in dealing with native grasses and forage plants, and to offer suggestions for their future guidance.

Central Texas may be considered a typical stock section. The problems here presented are identical with those of other regions where overstocking and insufficient care of the natural growth of grasses and forage plants have led to the impoverishment of the ranges. The natural herbage of the Southwestern plains and prairies was once as varied and as rich as could be found anywhere. The wild grasses could not be excelled either for hay or pasturage. They are still to be found scattered over the region, not in as great profusion and abundance as in the days when the cattlemen first drove their herds into that magnificent pasture, but enough of them are there to make it possible by intelligent management to produce something like the former conditions.

PHYSICAL CHARACTER OF THE COUNTRY.

The central Texas of this report includes all the counties of Stonewall, Haskell, Throckmorton, Fisher, Jones, Shackelford, Nolan, Taylor, Callahan, Runnels, Coleman, Tom Green, Concho, McCulloch, and parts of the counties of Kent, Scurry, Mitchell, Coke, San Saba, Brown, Eastland, Stephens, and Young. It embraces a territory about 100 miles wide, east and west, and about 200 miles long, north and south.

The characteristics common to these counties are: An open prairie country with some black-jack, post-oak, and live-oak timber on the uplands and ridges; a scattering growth of mesquite on the lands away from the streams, which, together with the timber on the streams, supplies ample firewood and posts for fencing purposes; numerous streams that furnish an abundance of water, fringed along their banks with groves of pecan, elm, hackberry, wild china, cottonwood, and other trees; an altitude ranging from 1,500 to 1,900 feet above sea level; an annual rainfall of from 20 to 34 inches, the average being about 27

inches, so distributed through the year that it means sufficient for range purposes, but periodically not sufficient for the best results in farming; a range of temperature from 90° to 102° down to 7° F.; a rich alluvial soil in most of the valleys, while on the uplands there are loams, generally containing a large admixture of calcareous marls. The soils vary in color from a light gray or yellow, through all the intermediate colors—chocolate, mulatto, red, and brown—to black, all productive and susceptible of high cultivation, and especially rich in the elements necessary for the production of the cereals and grasses. There is a great variety of native forage plants and grasses, comprising species that appear in succession from February to November.

In Stonewall, Nolan, Mitchell, McCulloch, Coke, San Saba, and Taylor counties the topography presents a greater diversity than in the others. In Taylor County there are considerable elevations, a mountain range extending through it from southeast to northwest, the highest point being 519 feet above the surrounding plains. In Throckmorton, Stephens, Shackelford, Callahan, Runnels, Coleman, and Tom Green counties there are broken areas. In the other ten counties, where there are neither mountains nor hills, the general surface is gently undulating.

Under the direction of the Agrostologist of the United States Department of Agriculture, portions of this section were visited by the writer during August, September, and October (1897), and collections of grasses made, notes being taken relative to the forage plants, native and domesticated, that have given promise of future value. These observations, owing to the limited time in which they were made, do not cover all the counties named, but it is probable that nearly every grass noted may be found in each of the counties, and the statements regarding them will doubtless apply to the entire region.

EARLY CONDITION OF THE RANGES.

The natural meadows of this section when the first cattlemen took possession were excellent. It was an ideal pasture land. The streams were full the year round, and the absence of heavy dews or long-continued wet spells in autumn caused the abundant growth of grasses to ripen and cure on their own roots into hay of the best quality, available through all the winter months. There was shelter from storms in the timber along the streams. The prairie dogs and jack rabbits were kept in check by their natural enemies. The rapid spread of weedy shrubs and cactus was prevented by the annual fires that swept the country.

No attempt at systematic settlement was made until the building of the Texas and Pacific Railroad in 1883. Before that time there was no one to assert any special claim to any particular lands. True, nearly all belonged to private individuals, railroad companies, counties, or to some of the State trust funds, but none of the legal owners were

on the ground in person. There was nothing to prevent the cowmen from appropriating the range, arbitrarily laying off their range boundaries, and claiming them under their so-called "range rights." The first cowman who entered a given section established his headquarters in some favored spot and claimed, under his range rights, everything in sight. When the next cowman moved in, the two together divided the range and each kept his herd on his own side of the boundary line agreed upon between them. As others came, the range was further subdivided until it was all fully occupied. Absolute good faith was maintained, each recognizing the range rights of the other. There was no need for one to crowd the other, for there was plenty, and to spare, for all. They each and all recognized that with "free grass" the road to wealth was an easy and certain one.

SPECULATION AND OVERSTOCKING.

With the entrance of the railroad into this pastoral region the owners of the lands under consideration, or their agents, began to appear with a view to looking up their properties. Then it was that the cowmen began to realize that they could not longer depend on free grass. The result was natural, indeed inevitable. Every man was seized with a desire to make the most of his opportunities while they lasted. Whereas there had previously been no rent to pay and only a minimum of taxes, each one saw that this situation could not last. In consequence every man who had a "range right" went into the market to buy cows to eat as much of the grass as possible before he should be dispossessed of his free holding. Soon there were more buyers than sellers. Prices went up and a fever of speculation ensued. Range rights, herds of cattle, and flocks of sheep changed hands at fabulous prices. Men of every rank were eager to go into the "cow business." In a short time every acre of free grass was stocked beyond its fullest capacity. Thousands of cattle or sheep were crowded on the ranges where half the number was too many. The grasses were entirely consumed; their very roots were trampled into dust and destroyed. In their eagerness to get something for nothing speculators did not hesitate at the permanent injury, if not total ruin, of the finest grazing country in America.

From that day to the present but little intelligent effort has been made to improve the pastures and again cover them with the rich vegetation which the soil is capable of supporting. It is not yet too late to remedy the evil, but no time is to be lost. There is need in the first place of the enactment of more beneficent lease laws to govern the use of county and State lands. Permanency of tenure is essential, for it is only through such a condition that stockmen can be made to see that it is to their own interest to improve the carrying capacity of the range. There must be intelligent and concerted effort, and it can not be expected that stockmen will be different from other men if they decline to make such effort at range improvement when the results of their toil and

forethought are to be enjoyed by others. They are all alike, grass destroyers, so long as it is not to their own immediate interest to be grass preservers. Stockmen have been reckless in this direction, farmers have been their allies. The latter still wage a war of extermination on the grasses growing in and about their fields. In his effort to make room for more cheap cotton the farmer ruthlessly breaks the sod that if properly treated and cared for as pasture would yield him far better returns.

HOW THE STOCK RANGES MAY BE RENEWED.

In considering the question of how the ranges may be renewed, the ideas and opinions of the leading stockmen of this section have been solicited. They vary from that of giving the grasses absolute rest until the ground has been reseeded with the best native varieties, to that of partially breaking the sod and seeding down the land to sorghum, Johnson grass, or the best of the tame hay grasses.

If the natural pastures are to be once more brought up to their original condition certain precautions must be taken. There must be no more overstocking of the range. On the contrary, as far as practicable, the land must be systematically rested. Some of the leading stockmen are now dividing up their holdings into several pastures, one being held exclusively for winter use, another for spring, another for midsummer or autumn. This practice will, in the case of the winter pasture, enable the early grasses to ripen and shed their seeds. To be successful there should be rotation in the seasonal use of these pastures. Thus a pasture which is grazed closely during winter for three or four successive years should then be grazed only in summer for a like term, in order that the late-maturing grasses, which would naturally be the ones eaten during the winter, may have an opportunity to reseed themselves and regain their former abundance. By this system of rotation the carrying capacity of the pastures may be doubled or trebled in the course of a few years.

NEED OF HAY AND OTHER FORAGE.

It will be necessary also to provide hay and forage, which may be used during storms or in case of unusually severe winters, or in years when through drought or other causes the natural herbage is less than the normal. The range grasses, even when abundant, may be so injured by such unusual occurrences as heavy autumn rains as to be worthless as food for stock. During the severe winters thousands of cattle and sheep often die from starvation. Five per cent of their value invested in hay or other feed and kept available for use during winter storms would not only have saved their lives, but have brought them through the season in growing and healthy condition. Vast quantities of hay could a few years ago be secured anywhere for the cost of cutting and curing. With a renewed range this condition may be again attained, and even if the wild hay can not be depended on or can not be secured

a sufficient crop of sorghum, Kaffir corn, or some of the coarser cultivated hay grasses should be planted to supply feed in times of scarcity.

Hay meadows formed of native grasses are greatly needed. These native grasses have in the past shown all the best qualities of hay grasses elsewhere, and they do not require any experimental work to determine their adaptability to soil and climate or their general value. More than a third of all the grasses in the United States grow within the confines of the state of Texas, and the establishment of natural hay meadows of the wild grasses and forage plants is bound to prove successful and profitable. The first question to be determined is, which are the best for hay and which for grazing. Stockmen can do this work on their own ranches and settle the question for themselves. They can prepare and seed down lands with the best grasses and save hay every year for winter use, thereby adding largely to the capacity of their pastures for carrying stock. As soon as dependence is placed on hay or fodder the pastures are bound to improve, because stock fed a part of every year will need less pasture grass, and the pastures being allowed this periodic rest will more rapidly attain their best development.

NATIVE GRASSES AND FORAGE PLANTS RECOMMENDED FOR PROPAGATION.

In a consideration of the different native grasses and forage plants it has not been possible to inspect the ranges in all the counties, but those here discussed may be taken to fairly represent the entire section. Of the many varieties found, the following, from personal observation and from the accounts given by ranchmen and farmers, appear to be the most valuable:

GRASSES.

Western Wheat-grass (*Agropyron spicatum*) is a blue-stem which is rather wiry. It is from 20 to 30 inches high, and grows luxuriantly all over central Texas. While it will not produce as much hay to the acre as some other species, stockmen value it highly for its nutritive qualities. It withstands the droughts to which the section is periodically subject, and is to be found not only on the uplands, but also in the low moist meadows. It is also known in the Northwest as Colorado Blue-stem.

Feather Sedge or Feather Blue-stem (*Andropogon saccharoides torreyanus*) (fig. 1) grows in all of the counties of central Texas. It has a feathery looking "seed head" and a blue stem, grows from 2 to 3½ feet tall, and ripens an abundance of seed in September. When cured it is soft to the touch and is much relished by cattle. This is a common grass on the dry prairies and mesas from Kansas to Texas westward to Arizona and southward into Mexico.

Bushy Blue-stem (*Andropogon nutans*), a very tall, cane-like grass, growing principally in rocky places, though it is also on the open prairies. It will produce good hay in large quantities.

Side-oats Grama (*Bouteloua curtipendula*), one of the best native grasses in central Texas, is highly regarded by stockmen. It was splendidly seeded in September when examined on the range. It grows equally well on the uplands and lowlands, in fallow ground and in the pastures. Cattle are very fond of it both before and after it ripens seed. It produces a great many seeds that do not shatter out readily,

and, as it grows from 18 inches to 3 feet tall and makes a large quantity of fodder, soft when cured, it is an excellent hay grass. It is common throughout the prairie region and on the plains extending eastward to Pennsylvania.

Black Grama (*Bouteloua hirsuta*).—Black grama is not as common throughout central Texas as stockmen would like to have it. It is not a hay grass, as it does not often grow tall enough for the mower, but it is certainly one of the best grasses for grazing purposes. In appearance it closely resembles the blue grama (*Bouteloua oligostachya*), which is one of the most common of the native grasses of the "benches" of Montana. Several stockmen of Mitchell and Taylor counties state that this black grama is "taking the prairie" rapidly, more of it being seen in 1897 than in former years.



FIG. 1.—Feather Blue-stem.

Blue Grama (*Bouteloua oligostachya*) (fig. 2).—Very similar in most respects to the black grama, about the only difference noticeable by the unscientific observer being the lighter color of its "seed heads." It grows throughout all the cattle-raising States west of the Mississippi and is very common in Montana and Colorado, where it is known as Buffalo-grass. In central Texas it is regarded with much favor by stockmen. As it grows well on the high arid plains and bench lands and also on the lower and damper pasture lands, and is both a hay and a pasture grass, too high an estimate can not be put on it for stock purposes. It is said that "it far exceeds, in general opinion, the true

buffalo grass (*Bulbils dactyloides*), which has gained much of its credit at the expense of *Bouteloua*, the two being often confused by farmers and ranchmen."

Rescue Grass or Arctic Grass (*Bromus unioides*).—An excellent winter-pasture grass, but not widely distributed in this section. The specimen forwarded for identification was found in Nolan County, in September. At that time its seeds had shattered out badly, and its leaves were not green, nor was there much of it. Stockmen say, however, that earlier in the season it was to be found in fair quantities in Mitchell, Nolan, and Taylor counties. It has been reported from some of the other counties of central Texas, where it is valued both as a pasture and as a hay grass.

Arizona Millet (*Chaptalia macrostachya*).—A tall, rather coarse upland grass. It is a valuable hay grass because of its habit of growth, producing an abundance of fodder and seed. It is one of the most common grasses of this section of Texas.

Bermuda (*Cynodon dactylon*).—Probably not a native, but now so common in every part of this section that it is regarded as one of its distinctive grasses. It grows about the windmills where it is freely watered tall enough to be cut for hay. For grazing purposes it is doubtful if any other grass will furnish more or better pasturage. If

stockmen, instead of confining the propagation of it to their yards and lawns, would put down extensive fields of it, they would be amply repaid for the labor and expense. One stockman who has a 10-acre pasture well sodded with Bermuda grass says that he kept more than a dozen calves and 4 head of horses on it month after month, and that he frequently permitted as many as 10 extra horses to run on it several days in succession, and that he never thought he had overstocked it. In the cities of central Texas it is being used to improve the footpaths and lawns. Stockmen and farmers in the country are



FIG. 2.—Blue Grama.

using it to advantage to strengthen their dams and the banks of their water tanks.

Wild Rye (*Elymus canadensis*) grows in nearly every neighborhood. It is to be found occasionally on the uplands, but is more common in the valleys. Stockmen say that, when it is young and green, stock of all kinds is fond of it. They think it will make good hay. It is one of the most promising of the native hay grasses.



FIG. 3.—Everlasting Grass.

Everlasting Grass (*Eriochloa punctata*) (fig. 3).—This grass was found in Shackelford County in a stubble field, where stock were eating it greedily. This was in September, but a month later it was found in several other localities on the benches and in the valleys. A well-informed stockman of Taylor County says that it is a good pasture grass when it first greens out in the spring, affords good pasturage all through the summer months, and in autumn, when protected from stock, will furnish in abundance a good quality of hay. In the times when Fort Griffin, in Shackelford County, was occupied as a United States Government post, this grass was a main reliance of the troops for hay. At that time it grew all over that vicinity from 2 to 4 feet high, and, as large sections were covered with it to the practical exclusion of other

grasses, it was not difficult to secure hay in large quantities. Now, however, it is rarely to be found in quantities sufficient or under conditions suitable for hay purposes—another instance of the reckless manner in which the range in all central Texas has been abused. In the valley of the Clear Fork, a few miles below Fort Griffin, this grass was seen growing luxuriantly in a field where no stock was allowed, showing by its strong growth what it will do under favorable conditions. Farmers and stockmen should cultivate it with special reference to its high value as a hay grass.

Curly Mesquite (*Hilaria cenchroides*) (fig. 4).—Too much can not be said in praise of this superior pasture grass. Fortunately for stockmen, it is found in all the counties of central Texas and is about the most abundant, as it certainly is one of the most valuable, of all the native grasses. It has a peculiar habit of creeping over the ground and rooting at the joints of the stems, from which spring leafy branches that in their turn reach out for other places in which to take root. In protected localities it greens out very early in the spring, makes a thick mat of leafy turf during the summer, matures on its roots, and in the fall and winter, when not rotted by late rains, affords excellent pasturage for all classes of stock. No grass stands the long dry spells to which the section is periodically subject better than the curly mesquite. As it does not grow tall, sheep, horses, and even hogs are especially fond of it, and cattle prefer it to almost any other grass. In very dry weather it dries up and appears to be dead, but in a few hours after a warm rain it becomes green to the end of its smallest leaf blade and stem. When matured on its roots, it is very much better feed than at any other time, and stock will not only live but fatten on it without grain. It is doubtful if acre for acre it will support as many head of stock, year in and year out, as Bermuda grass, but it will stand drought better, and for general range purposes is certainly superior. When lands are sodded down to it and it is given the advantage of irrigation even by sprinkling, as is done in the case of Bermuda, it makes as attractive looking turf as the latter, especially when closely cut by the lawn mower. Some of the central Texas stockmen are sodding down small pastures, from 5 to 20 acres, with it, to be used as calf lots and for pasturing the ranch horses used about headquarters. They report that such pastures in a good year will support one head of stock per acre. It grows well on any but alkali soils, on uplands and lowlands, out in the open or in the shade. In Jones County there is a small pasture well sodded within which



FIG. 4.—Curly Mesquite.

mesquite trees of unusually large growth stand so close together that a wagon can with great difficulty be taken through. In this pasture the curly mesquite grows in the early summer quite tall enough to be cut with a mowing machine. Under very favorable conditions it could perhaps be developed into a good hay grass, but it is primarily and pre-eminently a pasture grass. A Callahan County stockman, finding that there were many naked spots in his pasture, took the roots of the curly mesquite and with an ordinary garden hoe put them in the ground, scattering them over such spots from 3 to 4 feet apart. This was in the early spring. By the following autumn they had rooted and sent out their creeping stems to take root, and had covered the bare places. This was a case of making two blades of grass grow where none grew before, and suggests a practical way for the renewal of all the much-abused pastures in and out of central Texas. On plowed land this grass will spread very rapidly, soon forming a fine turf. It will pay farmers and stockmen to make the experiment of growing it on plowed land.

Wild Timothy (*Muhlenbergia racemosa*).—Of all the native hay grasses of central Texas, this is one of the most valuable. It does not occur except in moist soils, but there it grows luxuriantly. A specimen collected near Abilene measured 4 feet 7 inches in height, and it is often seen over 5 feet tall. It is slender and erect, its stems soft even when cured, with an abundance of leafage that does not fall from the stems, many seeds that do not drop readily, and short but numerous creeping root-stalks. A farmer on whose place a lot of this was growing informed me that the only grass of the many varieties growing together on the place preferred by his cattle over this wild timothy was the wild oats (*Uniola latifolia*). An acre of good moist land seeded down to wild timothy ought to produce in a fair season 2 to 2½ tons of hay equal to the best grown in any country.

White Top (*Triodia albescens*) is another excellent hay grass. It has a very soft stem with an abundance of leaves, and in September was splendidly seeded. It is found principally in the lowlands, where it grows from 18 to 20 inches tall; and also on the uplands, even in sandy and rocky places. In Taylor County, near Lytle Lake, it grows luxuriantly, but only there in places where it has the benefit of subirrigation. It will doubtless prove a valuable grass for hay purposes when in cultivation, as stock are very fond of it.

Galleta or **Black Grama** (*Hilaria mutica*).—Up to a few years since this grass was not growing in any considerable quantities in the southern or eastern counties, although in the northern and western counties it constituted a large portion of the pasturage. Now, however, it has established itself in all the sections, and stockmen report more of it this year in Taylor, Callahan, Eastland, and Runnels counties than was ever seen before. It is an important grass on the Staked Plains. In Mitchell County it grows as well on the highest as on the lowest pas-

tures. Immediately on the line of the Texas and Pacific Railroad, in the latter county, is the Iatan Valley, and a few years ago there were several thousand acres of this grass growing there, practically to the exclusion of other sorts. The stiff red clay soil seemed peculiarly fitted for its growth. Stockmen in that vicinity were in the habit of cutting it every year; it made an excellent quality of hay, much valued by the livery-stable men of Colorado City and Big Springs. It was in fact preferred to the baled hay shipped from other sections of Texas. Now comparatively little of this grass is available for hay purposes. It is recognized by all stockmen as being a valuable pasture grass.

Alkali Saccaton (*Panicum bulbosum*).—There is but little of this grass in central Texas and stockmen do not know much about it. Farmers report that it only recently made its appearance in cultivated fields. It will prove a valuable hay grass, though it is light for its bulk when cured. The specimens gathered grew on a valley farm in Eastland County.

Barnyard Grass (*Panicum crus-galli*) (fig. 5).—The local names for this are goose grass and sour grass. It grows best in moist soils, in the prairie and Southern States, but until about 1893 was unknown in central Texas, so far as reported. That year it made its appearance in several of the counties, and was supposed by farmers to be Colorado grass (*Panicum texanum*). It is found only in cultivated fields, or in the immediate vicinity of barnyard buildings. It grows in bunches from two to four feet high, makes a great deal of fodder and seeds, and when cured is soft to the touch. Cattle eat it with evident relish. It has a great many small roots that spread out near the surface of the ground. One farmer referring to it said: "It is easy to rid a field of it, as it can be kicked out of the ground roots and all, or easily knocked out with the back of a hoe." Specimens were collected in Jones, Taylor, Eastland, Nolan, and Shackelford counties. Under cultivation it will doubtless prove to be a great hay grass.



FIG. 5.—Barnyard Grass.

Beardless Barnyard Grass (*Panicum crus-galli muticum*) grows best in wet lands from Louisiana to southern California and as far north as the Dakotas. It is similar in appearance to the common barnyard grass, having about the same habit growth, about the only difference being its beardless "seed-heads." Farmers who are familiar with it regard it as a promising hay grass for wet meadows.

Cotton-top (*Panicum lachnanthum*) is found in cultivated fields and grows from 16 to 32 inches tall. Its appearance indicates that it is a good hay grass. It has an upright habit, an abundance of leaves, soft stems,

and many seeds that do not drop readily. It is rather light in weight considering its bulk, but stock seems to relish it when cured. It was not found growing in pastures, being entirely eaten out by cattle.

Chaparral Millet (*Panicum reverchoni*) grows on the highlands, in pastures, and in cultivated fields. Although not a tall grass and producing but little fodder, its stems are soft when green, not harsh nor stiff when cured, and it ripens an abundance of seed. It is an excellent pasture grass that stands the dry weather well, and as such is especially valued by stockmen. If cultivated it might develop into a good hay grass.

Hurrah Grass (*Panicum reticulatum*) occurs only in cultivated fields or along the roadsides. It is not well known either among the stockmen or farmers. A farmer in whose



FIG. 6.—Colorado Grass.

field it occurred says that he has been observing it several years and esteems it highly. Cattle and horses relish it dry or green, and it is a promising hay grass. It would doubtless show a large yield under proper cultivation because of its abundant leaves and soft stems. It seeds freely in September, but the seeds quickly shatter.

Colorado Grass or Concho Grass (*Panicum texanum*) (fig. 6).—It is doubtful whether this can properly be classed as a native of central Texas, though there are many farmers, especially in Tom Green, Concho, Runnels, Coleman, and Brown counties, who insist that they

have had it in their fields, a native growth, for a great many years. It is now common throughout this section in cultivated fields. It does not ordinarily make its appearance until such field crops as Indian corn are about ready to be "laid by." Then it covers the ground, and by the time the corn is ready to be gathered it is nearly ready to be cut. Farmers here are beginning to "lay by" their corn with special reference to this grass. That is to say, when they plow it the last time they leave the ground as smooth as possible without furrows. Later they cut the corn, leaving as little of the stalk as practicable, so that the grass may be mowed, thus securing a hay crop hardly less valuable than the corn. In an oat field of about 7 acres the Colorado grass grew 18 to 24 inches tall and yielded a fraction under 2 tons of hay per acre besides the grain. All classes of stock relish it and it is very nutritious, but left too long it dries out and sheds both its leaves and seed. It was first observed many years ago growing in the valleys of the Colorado River in Travis County, where the farmers regarded it as the best of all their hay grasses. It is a grass that does not have a weedy habit, and land can easily be freed from it in one season by following with cotton, but few farmers care to get rid of it under any circumstances.

Switch Grass (*Panicum virgatum*) grows in low places, on the banks of creeks, near tanks and pools, or in valleys where there is moisture. It is also reported from the moist uplands. Stock eats it, especially when it is young, and after it matures they eat the seed heads and pick off the leaves. The great abundance of the latter is a marked characteristic of this grass. Specimens were secured at the Seven Wells, in Mitchell County, which measured fully 7 feet tall. In a pool near Baird, in Callahan County, it was growing fully 6 feet in close compact bunches. After the grass is seeded the stems are rather coarse and harsh, and stock no longer relish them. If cut before it gets too old it makes a hay of fair quality.

Water Grass (*Paspalum pubiflorum glabrum*) is a strong growing perennial which ought to make a good hay grass. It was noted only in the valleys, but a well-informed farmer of Eastland County, on whose place the grass occurs, reports that it also grows fairly well on the uplands. It is found in most of the counties of central Texas. It often grows 4 feet high, and as it produces a great abundance of soft leaves it is regarded as a superior grass. Meadow lands seeded down to it would undoubtedly produce in favorable seasons quite as much hay as an equal acreage of alfalfa or Colorado grass.

Texas Crow-foot (*Leptochloa dubia*).—An excellent grass found in Nolan County. It is worthy of being cultivated. Farmers in other counties to whom the Nolan County specimens were shown say that they have it growing on their farms, respectively in Taylor, Jones, and Runnels counties. It is a promising hay grass.

Drop Seed (*Sporobolus cryptandrus*).—Found in several localities,

but always in moist soils. Specimens were collected on the shores of Lytle Lake, in Taylor County, near the Seven Wells, in Mitchell County, on the Clear Fork of the Brazos, in both Jones and Shackleford counties, and on the Sweetwater, in Nolan County. It ripens but few seeds. The leaf blades are narrow but abundant. It is a bunch grass, a single clump sometimes being 12 inches in diameter. Stockmen report that all classes of cattle eat this grass with evident relish, especially before flowering and in the winter when it is cured.

There are a great many other grasses that have value either for hay or pasture purposes, or both, but those above enumerated are believed to be the most meritorious of those native of central Texas.

FORAGE PLANTS NOT GRASSES.

Stolley Vetch (*Vicia leavenworthii*) is a forage plant of decided value. It appears very early in the spring, and bears pods filled with small peas. It is eaten by stock in the spring and early summer. As late as September fair specimens of it were collected, but not in condition to be eaten by stock. The peas had shattered out and much of the foliage had fallen from the stems. It is to be found in most of the pastures in this section, and is known locally by a variety of names. One farmer claimed to recognize it as the Butterfly pea that grew in his native State of Georgia, but the vetch has the twining habit of a vine while the pea grows erect. A stockman who has held stock in Arizona and New Mexico says that a similar vetch grows there and is known as the Buffalo pea, while a farmer from Louisiana says it resembles the Partridge pea. Several parties near Putnam, in Callahan County, experimented with this pea last year with satisfactory results. They report that it blooms from March to the middle of May and that the peas ripen while it is still blooming, after the habit of the English garden pea. A county official of Callahan County says that several years ago in February he saw this pea in full bloom about Aledo, in Parker County, where it grows wild in great abundance.

Tallow Weed (*Actinella linearifolia*).—Every sheep raiser in all the stock counties of Texas knows the habits and value of this remarkable forage plant. It is not a very common growth, but occurs in almost every one of the counties in this section of Texas. It has somewhat the form of young lettuce when it first appears. Later it puts out a yellow blossom that fills the air with its rich perfume. Still later it forms a seed head resembling somewhat that of a yellow clover. It flowers in the early spring and is ready for all kinds of stock in advance of any other weed or grass. Some of the accounts given by enthusiastic stockmen as to its merits are almost too wonderful to be fully credited. For instance, one who has a ranch on the Clear Fork of the Brazos, in Jones County, says that a few years ago, when a hard, wet winter had followed on the heels of a very dry summer, the little grass that was available rotted before Christmas, and, having laid up no hay, grain, or

other winter feed for his stock, he was gravely apprehensive that he would lose a great many of them before the early spring weeds and grasses would appear; but his range, it seems, was well seeded with the tallow weed, which continued to grow all the winter, and not only kept his stock alive but fattened them. He declares that when the spring opened he had beef steers fat enough to be put on the market, fattened entirely on this plant. A sheep raiser of Tom Green County, in 1892, had his sheep on a ranch that was in both Tom Green and Crockett counties. During the early winter of that year his ranch on the Concho River, in Tom Green County, where he was then holding his sheep, was overflowed and he lost all the hay and grain he had laid up as winter feed for his stock. The roads from his ranch to the railroad were impassable on account of the frequent and heavy rains. Practically all the grass on his Concho River ranch was rotted by the rains. By midwinter his sheep were so thin that it looked as though most of them would die from starvation before spring. Early in January he started his sheep to this Tom Green and Crockett County ranch. He found there, early in January, quite a large proportion of this range covered with tallow weed just beginning to bloom. Up to that time he had no knowledge of its habits and value, but as his sheep ate it with evident relish; as there was nothing else for them he permitted them to eat their fill of it. In a short time they showed signs of improvement and by the first of March, when the weed was in full bloom, they were in satisfactory condition. Naturally this rancher is a firm believer in the tallow weed, which, according to him, "will put more tallow on the kidneys of any kind of stock than the same bulk of any other forage plant that ever grew in any country under the sun." So far as known the tallow weed has never been cultivated in this section, and as it rarely grows very tall on the range no effort has been made to cut it for hay. In a cultivated field it will grow tall enough to be cut for hay which will be equal to the best. No chemical analysis of tallow weed has been made, but a forage plant that will, while green, fatten sheep and cattle, without other feed, in the winter and early spring must when properly cured prove very nutritious.

Fall Tallow Weed (*Amblyolepis setigera*).—Found in October growing luxuriantly, protected by a brush fence, on a ranch about 5 miles north of Abilene. When within 200 yards of the spot where it was growing the familiar, rich, pungent, thoroughly agreeable perfume characteristic of the true tallow weed (*Actinella linearifolia*) could be recognized. That found as above stated was growing much after the habit of the clovers. It promises to be a superior hay producer, and may be recommended for cultivation by farmers and stockmen.

Careless Weed (*Atriplex obovatum*) grows anywhere and everywhere all over central Texas. It often grows in soils too strong with alkali for grasses. While not stating authoritatively that it prefers alkali soils, yet it does thrive under such conditions, and the suggestion is ventured

that it may have a special mission worthy the consideration of stockmen and farmers—to reclaim alkali lands. It grows tall enough to be cut, and both its leaves and small twigs are eaten by stock. I know of no instance where stock have had to depend upon it entirely for food, but as a rule they know what is nutritious, so that it is quite probable that the “Careless Weed” has a special value as a forage plant. A reliable sheepman of Concho County says that sheep eat it greedily. It produces enormous quantities of seed, and every year reseeds the land where it grows. A Mitchell County sheepman thinks that sheep eat it because of its tonic properties. It has a bitter principle that suggests such an idea. On the high plains of Nevada and Utah, and in Arizona and New Mexico a similar species (*A. palmeri*) furnishes a considerable

part of the winter forage for both cattle and sheep. Cattlemen who have held cattle on the range in Arizona say that a salt bush, sweet sage (*A. canescens*), very similar to this in many respects, is a principal reliance in that section for all classes of stock.

Beggar Weed (*Desmodium paniculatum*).—There is some prejudice in the minds of many persons against this excellent forage plant because of the fact that its seeds have a way of fastening themselves to one's clothes. But this is only an incident that ought not to be considered in deciding upon its value for for-



FIG. 7.—Wild Bean.

age. The fact is, horses, cattle, and sheep are all fond of it. It thrives best in low and moist soils, but it is also to be found on the uplands. The specimens collected grew in a rich, moist, sandy loam. The stems are rather inclined to be woody, but when growing thickly, as frequently happens in this section, the entire bush is easily convertible into hay. As a renovator of wornout soils or as a green manure no better nor cheaper fertilizer can be used than to turn under the rank growth of the beggar weed. The tap root descends deeply into the soil, bringing up mineral fertilizers from the subsoil which can be utilized by other crops. As it makes an excellent quality and a great abundance of feed for stock, it is recommended that farmers and stockmen familiarize themselves with the habits and general good qualities of this beggar weed.

Wild Bean (*Phaseolus helvolus*) (fig. 7) is found on low moist lands throughout central Texas. The vines are frequently seen clinging to

tall trees and growing up to their very tops. One such vine in Eastland County measured nearly 50 feet in length. This bean furnishes a large quantity of fodder that is eaten by cattle and sheep. It is a perennial with slender stems, and if properly cultivated will prove a very valuable addition to the forage plants of this section. It grows best in woodland copses along the banks of streams or in low moist valleys where it finds tall and strong weeds or grasses upon which to cling.

Needle Grass or Dog-town Grass (*Aristida fasciculata*).—There is an impression which obtains among other than cattlemen that this grass is a nuisance rather than an advantage to the range. But a careful investigation demonstrates that it is one of the most valuable, all things considered, of the pasture grasses found in this section. It is true that the needle-like seeds when ripe render the grass in some respects objectionable. For instance, they attach themselves to the wool of sheep, work their way through it to the bodies, and inflict on them ugly wounds that not only cause serious inconvenience, but sometimes result in real injury to the animals. Especially is this the case with lambs. Again, no class of stock seems to relish the grass while the needles are still attached. Cattle eat it at such times when forced to do so because of the scarcity of other grasses, but sometimes the needles pierce their tongues and otherwise wound their mouths. However, the damage done to cattle and sheep in this way has undoubtedly been greatly exaggerated. On the other hand the good qualities of the grass have been greatly underestimated. It is one of the most common pasture grasses in this section. It is less subject than any other to the destructive tendencies of prairie dogs. Owing to the peculiar beards on the seeds, this grass reseeds itself after all other grasses have been destroyed by the dogs near their holes. The seeds, when shed from the stems, are blown over the ground, fasten themselves to the earth, and work themselves down into it. As they are blown about over the range they fasten themselves to bare spots, which are the result of many different causes, and so renew them. It has been suggested by some stockmen that a very good way to speedily renew all our ranges would be to run furrows from east to west at short intervals through them. These furrows would catch the drifting seeds of this and other grasses as they are blown along by the prevailing south winds. The seeds would readily attach themselves to the loose soil of these furrows. This would assist the natural tendency of the ranges to renew themselves. But, aside from these considerations, this grass has another special value. It is one of the first of all the range grasses to become green in early spring. It affords good feed to all classes of stock while the grass is young and before the seeds become stiff and troublesome. That it possesses very nutritious qualities no one familiar with it will deny. Indeed, some of the best informed stockmen of this section say that they regard it, when stock can eat it

safely, as being quite as fattening as the curly mesquite. After the seeds are shed there is no better grass on the range. It has the habit of the curly mesquite of curing on the roots. No matter how dry it may look to be, after a warm rain it will green out to the end of its blades and stems. Some say that horses and cattle will not eat it after it has shed its seed and has dried out. This, however, is a mistake. To satisfy himself on this point the writer has been on the range with a view especially to ascertain the fact, and has seen cattle, horses, and mules all eating it greedily under such conditions. One of the best informed stockmen of central Texas, when asked his opinion on the value

of this grass, said: "It is about the earliest of all our pasture grasses; it is as nutritious as the best; stock eat it before the seeds become harsh and after they are separated from the stems; and it contributes more than any other grass to the annual renewal of the range. It is a main reliance with the cow men throughout this section. I regard it as one of the most valuable grasses for general purposes that we have."

Buffalo Grass (*Bulbils dactyloides*) (fig. 8).—It is more than probable that stockmen frequently mistake this grass for the different varieties of grama. It is a very common grass throughout central Texas, which is not the case with the gramas. Certainly in this section it is more valuable than the others, since it furnishes very much



FIG. 8.—Buffalo Grass.

more stock feed than any, or indeed all, of the gramas put together. There are many who perhaps esteem the buffalo grass more highly than it deserves; but there are more who do not give to it the credit to which it is really entitled. A range well seeded down to it, with curly mesquite and needle grass, is an ideal stock range so far as the grasses are concerned; and it is a very common thing in all this section to find just this combination. The greater the variety of pasture grasses the better the range for practical purposes, but stockmen in this section would not willingly exchange these three for any other mixture.

GRASSES AND FORAGE PLANTS OF PROBABLE VALUE.

In addition to the above 34 varieties of grasses and forage plants, the following are worthy of being carefully studied by farmers and stockmen:

Bur Grass (*Cenchrus tribuloides*).—This is another grass that is much abused, even by well-informed stockmen, on account of its peculiar thorny bur-like seeds, and because in cultivated fields it is a bad weed. It is pretty well distributed throughout the United States, east and west. In this section it has a real value that more than offsets its disadvantages. That is to say, it withstands dry weather better than many of the other grasses found here. A great deal of it was seen in September on a range in Mitchell County. Every pasture grass except those in the moist valleys was looking dry and cured except bur grass. The latter was as green as a young wheat field, and loaded down with seed. In traveling over this section, in September and October, whenever one notices an especially green spot on the range it may safely be assumed, without examination, to be the bur grass. After it has shed its seed it is relished by all classes of stock, and stockmen, while finding much fault with the seed, agree that it is very nutritious. It is also valuable when young or before the bur-like seed is formed.

Wild Millet (*Chaetochloa italica*) is found as a weed in cultivated land, in Nolan, Taylor, and Eastland counties. It grows, under such conditions, to be from 18 to 30 inches tall, seeds freely and produces a fair amount of fodder. It has the appearance of being a good hay grass. Its growth as a weed indicates somewhat the adaptability of millet and Hungarian grass to these central Texas soils.

Sedges (*Cyperus* and *Carex* species).—These are not true grasses, technically considered, but are so regarded by stockmen in this section. They are distributed over a wide extent of country, and while occurring chiefly in the low and moist valleys, there are some that grow well on the uplands and even among the rocks. Stockmen do not as a rule value the sedges highly for pasturage, because while they become green in early spring and stock eat them until the seeds commence to form, they do not supply a lasting forage. By that time other and better grasses abound, and stock do not then care for them, and will not eat them if they can get anything else.

Bog rushes (*Juncus* species).—These also are not true grasses, although from their grass-like habit they are so regarded by stockmen. The most common sort grows on high and rocky places. They produce many seeds that do not drop readily, and the stems are slender, but rather harsh, and produce little fodder. An intelligent farmer says that these rushes are eaten by cattle, and possibly some of them are of value as low-ground forage plants, as are the sedges.

Satin Grass (*Muhlenbergia tenuiflora*) was first found in Eastland County, but it has since then been reported from several other counties of this section. While not common, it is here in sufficient quantities to

entitle it to consideration. There is much difference of opinion among farmers as to its merits. It is not met with except on farms, growing near streams. Stockmen who are not also farmers do not appear to know anything about it. It produces an abundance of foliage and soft stems, and ought to make good hay. Specimens from Eastland County were nearly 3 feet high. After being fully cured it is soft, has a rich smell, and seems in many respects equal to the best native grasses of this section. It has slender, erect stems, long, narrow leaves, strong roots that take firm hold in the earth, and few seed (in September). If cultivated it might prove to be a fairly good hay grass.

Grapevine Mesquite (*Panicum obtusum*) grows in most of the counties of central Texas. It has long, creeping, jointed stems that root wherever they touch the ground, scanty leafage and that rather harsh, and a fair quantity of seed that clings well to the stems. It grows in this section from 18 to 24 inches high. There were no indications of its having been eaten by stock, although an observing farmer says: "They do eat it when they can't get anything better." Mixed with other and softer grasses it will perhaps prove of some value.

Crab Grass (*Panicum sanguinale*).—It is scarcely necessary to discuss this well-known grass, for whether a native of this section or not, it is here in great quantities and is a pest or a blessing according to the point of view from which it is considered. Growing in cultivated fields it is not very troublesome until corn and other field crops are about to be "laid by," when it asserts itself vigorously. Once it gets a foothold in a field it soon occupies every foot of the ground. This is the unfavorable view to be taken of it. On the other hand it furnishes a great abundance of excellent pasturage for all classes of stock. That it is nutritious can not be seriously questioned. Excepting on soils where it is not desirable for stock to run after field crops are gathered, this grass is valuable, adding largely to the capacity of farms to support the cattle. One class of farmers here insist that it is an unmitigated pest. Others say that while they would not deliberately introduce it on their farms, they are satisfied to have it remain. A few have expressed themselves as preferring it, one of these stating that both for pasturage and hay purposes a field well seeded to crab grass was, in his opinion, worth more year after year than the value of any other crop that could be grown. On the whole, it may be regarded as an excellent hay grass primarily, and incidentally as a good pasture grass.

Knot Grass (*Paspalum distichum*) (fig. 9) has a local name that, in a sense, very aptly describes it, "Eternity grass." A farmer on whose ground this grass was growing luxuriantly, when asked why it was so called, pointed out a stem of it and invited the writer to trace it back to the original root. He followed it through a dense matting of other stems fully 20 feet and gave it up. The farmer suggested that it be traced the other way, and again he failed after following it in the other direction about 20 feet. The farmer then explained: "Eternity is

defined as 'without beginning and without end;' if this grass has any beginning or any ending it is difficult to determine it." It grows in low, moist places, especially where periodically flooded. Owing to its creeping habit, it is not easily cut and hence is not available for hay purposes. One farmer gravely stated that stock would not eat it. Later the writer visited his pasture where the knot grass grew luxuriantly. The grass was abundant, and while there were many varieties of rich grasses all around, his horses and cattle were hunting for and eating every little sprig of it that they could find. This conclusively demonstrated that knot grass is valuable and worthy of consideration by stockmen. The creeping stems often measure 20 to 30 feet or more.

Wild Oats (*Uniola latifolia*) is an ornamental as well as a very valuable forage grass. It was seen only in one place in Eastland County, where it had made a luxuriant growth along the banks of small streams. Under the shade of the trees it stood from 36 to 48 inches high, and in September it was as green as a wheat field in spring, with every stem loaded with seed. The farmer at whose place it was found, in order to prove that it possesses special value, led a Jersey bull that he had tethered on crab grass near by, and turned him out where this wild oats was growing. The bull ate it greedily. Judging from appearances it ought to be a very valuable hay grass.

Prairie Sage Brush (*Artemisia ludoviciana*) is a showy forage plant which grows throughout this section. It may not have any very decided value for stock purposes, though stockmen say that cattle eat it. A sheep raiser says that sheep are fond of it and fatten on it. A Mitchell County farmer says that it grows well in alkali soils where little else will thrive. It is probable that it can be utilized with other plants for the purpose of reclaiming such lands.

Butterfly Pea (*Clitoria mariana*) was seen in several counties in this section. It has a light purple blossom and forms a pod that fills with peas nearly as large as the small garden pea. It grows upright and stands erect. When cut and cured it makes a soft and rich hay that is

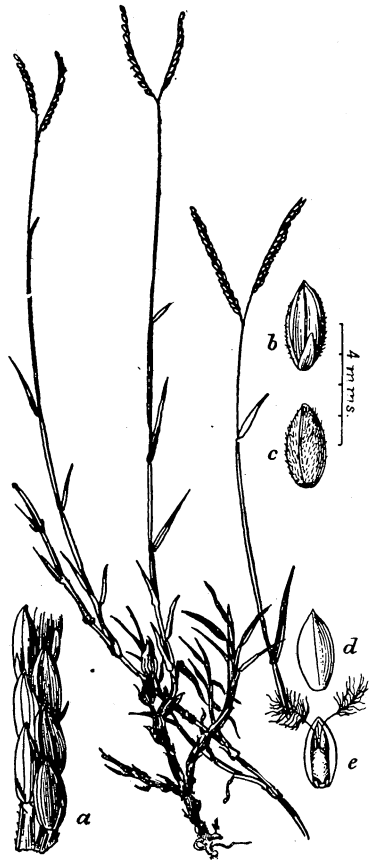


FIG. 9.—Knot Grass.

eaten by cattle and other stock. It grows principally in low, moist soils and on the banks of streams. A farmer in Eastland County says that some years his meadows were covered with it, and that a field planted to it and cultivated would yield several tons of good forage per acre. He thinks it will not withstand the long dry spells to which this section is periodically subject.

Bushy Knotweed (*Polygonum ramosissimum*) first attracted the writer's attention because of its enormous production of seed. Bushes of it found in pastures appeared to have been grazed. Cattle are fond of it when it is young and sheep will eat it whenever and wherever they can get it. It flourishes under many and varied conditions on high and low lands, in rich or poor soils, and withstands drought well. A stockman who has been much in Montana and other Northwestern States says that this or a similar weed grows there and furnishes nutritious forage throughout the summer and early autumn months. It is an annual, growing here from 15 to 30 inches high, according to the soil. A Calahan County farmer says that when mixed in with the hay grasses of the section it adds to the value of the hay, as its seeds are rich in fattening properties. He furthermore says that when cured its stems are very stiff, and only the seed and leaves are relished by stock. It deserves favorable consideration by farmers and stockmen.

Woolly Plantain (*Plantago gnaphalioides*).—There is much difference of opinion here as to the value of this plantain. In September its erect stems are loaded with seed. A Mitchell County stockman says it is always about the earliest spring forage and that cattle then eat it readily. It is usually to be found only in winter pastures where cattle have been kept for months. On the other hand, some regard it as a pest, though admitting that stock sometimes eat it.

Purslane (*Portulaca oleracea*) grows in every county in central Texas and is known locally as "hog pusley." It prefers fallow ground and is to be found in all the fields, but also grows well in pastures, especially in sandy soils. It stands dry weather well, and no matter how dry the grasses and other weeds may be its fleshy leaves and stems are abundantly in evidence. There is no doubt as to its value as a forage plant. Hogs will fatten on it and sheep are fond of it. Cattle do not appear to care for it particularly except in the droughty autumn months, when its succulent herbage is greedily sought for.

Cotton Purslane (*Portulaca pilosa*) is another variety of purslane that is a native of and grows abundantly throughout this section. It is a smaller plant than the other species above mentioned, but has about the same value as a forage plant.

COMMON GRASSES OF LITTLE FORAGE VALUE.

The following grasses, natives of central Texas, while perhaps less valuable than those above described, are worthy of consideration:

Triple Awn (*Aristida arizonica*) resembles in some respects the

well-known needle grass (*A. fasciculata*). It is an upland rather than a valley grass. It is more frequently found in sandy and gravelly land, and has economic value both as a pasture and hay grass. It is not very common in this section, but becomes abundant farther west.

Crow's Foot (*Chloris cucullata*) is a showy grass known locally as "crow's foot" on account of the shape and general appearance of its seed head. Although it produces a fair quantity of leafage and soft stems, it is not considered to have any value for either pasture or hay.

Feather Crow-Foot (*Chloris alba*) was noted in only one locality in Nolan County. The specimens secured were about 32 inches high, with an abundance of soft leaves and small seeds. It is a very ornamental grass, but is not worth much for forage purposes, as it is not eaten by cattle as long as better grasses are available.

Love Grass (*Eragrostis pilosa*).—This is not a common grass in this section and is not regarded as possessing much value.

Stink Grass or **Candy Grass** (*Eragrostis major*) is well known throughout this section. With its feathery looking ornamental "seed head" and abundance of leaves, it would produce a large amount of light hay, which, however, is not considered very palatable because of its somewhat offensive odor.

Love Grass (*Eragrostis secundiflora*).—This resembles the Candy grass, but is less frequent in this section. It grows in saline and strong alkali soils, and has little forage value.

Muhlenbergia arenicola is found in many different situations in this section, in the valleys, on the foothills, in rich soils, and among rocks. It resembles needle grass (*Aristida fasciculata*) both in appearance and habit; and while not well known here it is considered a valuable early pasture grass. Stockmen state that it greens out very early in the spring, withstands summer droughts, and is relished by stock. It seems to prefer the higher and drier uplands.

Old Witch Grass or **Tickle Grass** (*Panicum capillare*) is very abundant in this section. It prefers sandy soils and cultivated fields. It is a very showy grass, and stock will eat it when it is young, but it is not nutritious, and is therefore not very valuable.

Hairy-flowered Panic (*Panicum ciliatissimum*) is not properly appreciated by stockmen in this section. It will not produce a great abundance of hay, but the hay is rich and soft, and stock eat it with evident relish. It weighs light considering its bulk, but will do well to mix with other hay grasses. A specimen collected in 1897 measured 42 inches in length. It has the creeping rather than the erect habit, and is certainly a fair pasture grass. It is not a very common grass in this section. Locally known as carpet grass.

Brown Top (*Panicum fuscum*) is a tall hay grass which when young is eaten by cattle and horses. It grows chiefly in cultivated fields, and is similar in its habits and appearance to the barnyard grasses. It is valuable and ought to be cultivated in this section, and may well repay

all the labor that may be bestowed on it by developing into a first-class hay grass.

Hall's Grass (*Panicum hallii*).—There are several varieties of grasses common in central Texas which resemble each other so much that only experts are able to distinguish their differences. They all produce a great abundance of small seed, one of their marked characteristics. Hall's grass is one of them. It grows in all the counties of this section, is a fair pasture grass, and, while not so tall as some of the other varieties mentioned, it will produce a lot of soft and nutritious hay. Farmers and stockmen speak of it in favorable terms.

Sporobolus drummondii was noted only in Taylor County, although it occurs elsewhere in central Texas. It grows tall, with long, slender leaves, and in September had no seed and no appearance of having had any. The farmer on whose place the specimen was collected says that stock are fond of it when it is young, and he thinks it is perhaps valuable both for hay and pasture purposes.

Fall Redtop (*Triodia seslerioides*) grows in moist soils, especially near streams, in several counties in central Texas. Specimens from a valley in Eastland County measured 88 inches in height. It will furnish a great abundance of seed and soft leaves. Its stems are not large nor are they harsh even when cured. As a hay grass it may be worthy of special attention. An acre of good, moist valley land seeded down to it ought to furnish several tons of hay in a good season.

Gunaninpil (*Allionia incarnata*), a "four o'clock," is generally regarded as only a flower, but as an early summer feed, especially for sheep, it has a recog-



FIG. 10.—Tumble Weed.

nized value. It will grow again after being eaten down to the roots and withstands dry weather—two good qualities.

Tumble Weed (*Amaranthus blitoides*) (fig. 10) is not properly appreciated by stockmen. It grows extensively in all the counties of this section, and will readily be recognized by its name as above. When matured it either breaks from its roots or is blown out of the ground by the winds. Gathering itself into a ball it goes tumbling over the ground until stopped by wire fences or other obstructions. Hundreds of these plants may frequently be seen on the broad open prairies of Texas like balls 2 to 4 or even 5 feet in diameter, rolling before the wind like an army of living beings. When young it is greedily eaten by cattle and sheep, and furnishes a nutritious food. A farmer who has had some

experience in the matter of silos suggests that the tumble weed, if cut while young and converted into silage with other forage plants, would add much to the quantity and something to the quality of the product.

Water Purslane (*Ammannia coccinea*) is not a common plant in this section, but is to be found in wet places throughout central Texas. It has a harsh stem, few leaves (in September), but a great many seeds, that cling tenaciously to the stem. A Jones County farmer and stockman reports that stock eats it in the spring. The plant is worthy of being investigated.

White Sage, Sage Brush (*Artemisia mexicana*) grows in all the counties of this section. Opinions differ as to whether or not any kinds of stock eat it, but the most observant stockmen and farmers are satisfied that they do, at least in winter. It is quite probable that this and other closely related sage bushes supply some feed on the winter ranges.

Ground Plum (*Astragalus crassicaarpus*) (fig. 11).—Several varieties of this and closely related plants grow abundantly in central Texas. They have bean-like, purple and white flowers, and pods containing many seeds which rattle in them when ripe. Before ripening, the green and succulent pods are eaten by cattle and horses, which im-

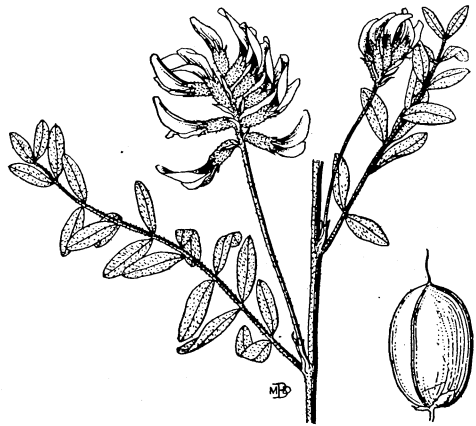


FIG. 11.—Ground Plum.

prove in flesh from the time these plants begin to appear. They grow abundantly in Eastland and Shackelford counties, and wherever they occur add much to the value of the forage on the ranges.

Fox Sedge (*Carex vulpinoidea*).—This is rather a common growth in most of the counties of this section of Texas. It grows to be 2 to 3 feet high and bears an abundance of wide leaves. Cattle relish it and sheep raisers say that sheep are fond of it when it first greens out in early spring.

Star Thistle (*Centaurea americana*).—There is much difference of opinion in regard to the value of this plant. Some of those who ought to know, insist that it is not worthy of consideration, while others claim with equal earnestness that it is one of the most valuable early forage plants of this section. A Callahan County farmer says that in the early spring of this year (1897) he was becoming apprehensive that his home bunch of cattle would suffer for feed before the grasses and weeds on which he usually relied for their early spring sustenance would appear. His milch cows, which were then being given the range of his fallow land as well as of a small pasture, instead of becom-

ing thin improved in flesh and the milk flow considerably increased. They came to the pens at night with their stomachs distended, and chewed the cud as contentedly as if they had been grazing in a first-class pasture. Investigating the matter, the fields and pastures were found to be covered with a weed from 3 to 6 inches tall, in appearance like a young tobacco plant, apparently this star thistle. The cows were eating of it greedily. Later it put up many stems from each root that grew to be from 2 to 3 feet tall. The flower was yellow and white and the seed head, when ripe, at a distance resembled that of the wild sunflower. Matured specimens of star thistle were found in great abundance in Callahan, Shackelford, Eastland, Taylor, Jones, and Nolan counties and were identified by various farmers as this forage plant. A farmer who resides in Burnet County saw it growing in Callahan County and says that the farmers of his neighborhood esteem it very highly as an early forage, especially for milch cows.

Lamb's Quarters (*Chenopodium album*).—A common weed throughout this part of Texas. When young it is used by housewives as a salad, but farmers here regard it as a valuable forage plant for cattle. It grows in pasture lands as well as in cultivated fields, appearing in early spring.

Grandpa's Beard (*Clematis drummondii*).—This vine has some value for forage purposes, as cattle often eat the leaves. Its fruits are very showy and give to the plant its common name, as above.

Wild Sages (*Croton* spp.) grow abundantly in this section, and if valuable for forage purposes the fact should be definitely determined and made known. Some farmers here say that cattle and sheep both eat them. On the other hand there are those who regard them as poisonous. It is possible that these sages have been confounded with other aromatic perennials which have much the same appearance and odor but which are known to be harmless.

Red Root Sedge (*Cyperus erythrorhizos*).—A species of sedge that occurs in many parts of this section and is believed to be a good forage plant. It grows 2 or 3 feet high, has a strong root, stools out like wheat, and forms large bunches of leafy stems which stock of all kinds eat. If cut before it becomes too old it will produce a large amount of nutritious hay. It grows only in wet or marshy meadows.

Hog Nut, Chufa (*Cyperus esculentus*).—A sedge that appears in early spring in low places. It produces tubers similar to those of the blue weed, though in much larger quantities. Hogs are fond of these and will root up the ground in their search for them. In some sections of Texas it is cultivated especially for hogs, and the tubers are said to contain large amounts of starch, oil, and sugar. As it withstands dry weather well it is recommended for cultivation in sections subject to periodical droughts, with the caution that it may, like Johnson grass, be difficult to eradicate when once established.

Ephedra nevadensis belongs to the same general group as the

pinus, fir, and spruces. It grows throughout this entire section, but is not very common. It is generally found on the high lands and, as a rule, on rocky or gravelly soil. It has a bushy growth, its forage being an abundance of slender stems, branching out from the main stem. It is known to possess extraordinary qualities, being an excellent blood purifier. Among the Mexicans and "old timers" of this part of Texas it is used to make a tea that is said to be palatable and is known to be healthful. Cattle eat it greedily, so that it may be considered valuable as a forage plant.

Alfilaria (*Erodium cicutarium*) (fig. 12).—A former hay contractor at Old Fort Griffin states that he is thoroughly familiar with this plant and that to his certain knowledge it grows quite abundantly in certain sections of central Texas. Other stockmen who are familiar with the range in New Mexico and Arizona also state that they have met with this plant in this part of Texas. The probabilities are that this plant or *Erodium moschatum* or both, may be found. If so, stockmen will have good reason to be gratified, as "filaree" is known to produce excellent forage, relished by stock.

Winter Fat (*Eurotia lanata*) is not very common in this section, but is found on the prairies in the northern and western counties of Texas. It is a fine winter forage plant and thrives in soils strongly impregnated with alkali. Both cattle and sheep eat it and do well on it.



FIG. 12.—Alfilaria.

Rosin Weed or Gum Weed (*Grindelia squarrosa*) is worthy of notice, because its stems, leaves, and flowers exude a gum that is very sticky. Stockmen regard it as very much of a nuisance, because the manes and tails of horses, the wool of sheep, and the heads and tails of cattle frequently become gummed up with it, to the no small discomfort of these animals.

Dwarf Broom Weed (*Gutierrezia sarothra microcephala*).—A well-known plant, recognized as having fair forage properties, since stock eat it to some extent.

Sunflower (*Helianthus annuus*) is said to be an introduced weed

here, but however that may be, it is now very common. It is not only very abundant here, but each year appears to be increasing. It is regarded as very much of a nuisance, notwithstanding the fact that both its leaves and seed heads make a forage that is eaten and relished by cattle, horses, and sheep. The seeds are especially rich in oil and very nutritious. It does not suffer, no matter how dry the seasons are, which fact suggests that in this section the sunflower, now much despised, may be made to cut a rather important figure in the matter of supplying forage for stock. An improved variety, having heads measuring from 6 to 12 inches in diameter, is being cultivated, the seed being fed to fowls and the fodder to cattle.

Artichoke (*Helianthus tuberosus*) is well known in many parts of Texas and grows wild on the banks of a small creek in Eastland County. It bears underground edible tubers that make good hog feed, and both cattle and horses will eat the foliage. It should be cultivated here.

Blue Weed (*Hoffmanseggia stricta*), the "Camote del Raton" of the Mexicans. Within the past two or three years it has appeared in this part of Texas, and is already regarded by the farmers as a pest. Having been informed that no cultivated crops would thrive where it grew, an investigation demonstrated the incorrectness of this popular belief. It grows in soils strongly impregnated with alkali, where such crops as wheat, oats, corn, and garden vegetables and vines will not thrive. This fact explains why they and the blue weed are rarely found growing together. A specimen was sent to the Department of Agriculture for examination by the Botanist, who says of it "I have received complaints of this plant, as a weed, from Anson, Jones County, and Murray, Young County, Tex. In both instances it is stated that the tubers are eaten by hogs and the foliage by cattle in dry weather. I do not know of any method of exterminating it other than by cultivation and thick seeding with crops that will choke it out. It is probable that grazing with sheep during dry weather would check the growth somewhat, but I do not think that it could be entirely exterminated by this means." It forms long creeping roots bearing fleshy tubers. From these tubers the roots branch out indefinitely. In the digging of a well near Escota, Fisher County, roots of blue weed with the tubers were found growing thirteen feet below the surface. As the blue weed will produce an abundance of forage and both the foliage and the tubers are eaten by stock it may be worth experimenting with in alkali soils. The tubers, however, are produced at such depths that it would be difficult to harvest them.

Wild Verbena (*Lippia nodiflora*).—A farmer and stockman of Jones County, who has about an acre of ground thickly covered with this plant, regards it quite as valuable for forage as an acre of alfalfa. He insists that it is a clover, and that it is identical with the prairie clover that is found growing a little farther west; but in this of course he is mistaken. The seed heads of the two are somewhat similar in

appearance, but this is about as far as the resemblance goes. This wild verbena produces an abundance of forage, that is eaten and relished by both cattle and sheep. It deserves to be tested thoroughly to determine its qualities.

Bur Clover or **California Clover** (*Medicago maculata*).—Well known on the Pacific coast, and found growing in the vicinity of Colorado, in Mitchell County. It is supposed the seeds were brought originally into this section in the wool of sheep shipped in from California. However, it may have come from the Gulf States, where it is common. It is not here in quantities sufficient to make it worthy of much consideration at present.

Prickly Pear (*Opuntia engelmanni*) (fig. 13).—In many counties in central and southwest Texas this well-known plant grows in great abundance, often from 6 to 10 and 12 feet high. A few years ago stockmen there began to utilize it for feeding purposes. They gathered the so-called "leaves," singed off the spines with fire, and fed them with cotton-seed cake to their cattle. The leaves and fruit are often fed to sheep. In this section of Texas this plant does not grow nearly so tall as farther south, nor is it nearly so common here as there. Still it is here in considerable quantities, and must be considered in connection with other forage plants native to this section. Herders

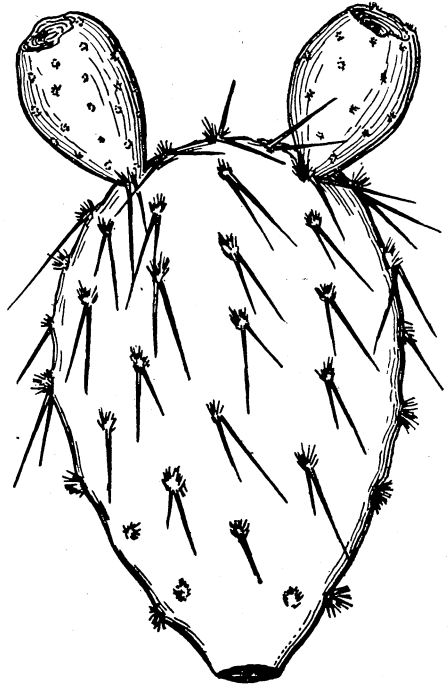


FIG. 13.—Prickly Pear.

who have used this plant on the dry plains of west Texas state that sheep fed on it do not require any other food or water, as the succulent stems contain a large amount of water and enough starch and gum to sustain life. It is often asserted that cattle and sheep, fed on the prickly pear with cotton-seed meal and hay, go into the markets as fat as those fed on grain and hay. If the prickly pear be fed alone it causes laxity, and when fed to working stock, a tendency to bloat. That it is one of the most valuable forage plants of Texas admits of no question.

Sorrel (*Oxalis corniculata*).—A well-known little plant, common to this section, called locally sheep sorrel or sour grass. It has a slightly sour taste and is supposed to possess tonic properties. Both cattle and sheep eat it.

Prairie Clover (*Kuhnistera*).—Stockmen here report that this species of clover, common throughout the prairie region, is to be found in many parts of central Texas. It contributes a considerable amount of good forage on the ranges and is much relished by stock.

Mesquite Bean (*Prosopis juliflora*) (fig. 14).—There are two well-known varieties of the small tree that produces this bean. In many of the counties of southwest Texas and along the Rio Grande the one bearing the screw bean or tornillo (*Prosopis pubescens*) is very common. The pods or beans are not only eaten by all classes of stock, but the Mexicans and Indians are known to use them as a food. The pods are

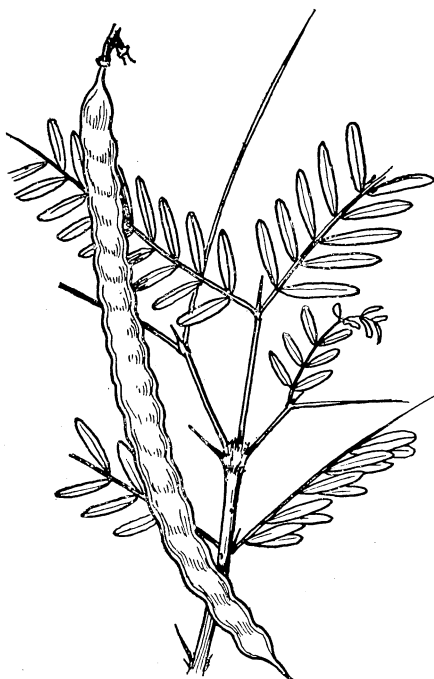


FIG. 14.—Mesquite Bean.

spirally twisted, while those grown on the other variety are straight or curved. There are really two forms of this latter variety. In one the bark of the tree is much rougher than in the other, and the bean is bright yellow when ripe and much sweeter to the taste, the color of the other being reddish rather than yellow. "A thorny, leguminous shrub, growing in favored localities to a tree from 20 to 40 feet high, with a trunk sometimes reaching 2½ feet in diameter. It is widely distributed from Texas to southern California, through tropical America to Argentina. The leaves are very good browsing for horses and cattle. It bears two or more crops of beans a year, which are next to barley for fattening horses, cattle, sheep, and hogs. The leaves, pods, and bark are rich in tannin, and a

gum similar to gum arabic exudes copiously from the trunk and branches. The wood is hard, strong, and durable, and takes a high polish. It is the most common tree of the mesas of the Southwest, and because of its many uses is an exceedingly valuable species." Experiments in a small way have been made here to preserve the beans for winter feeding with partial success only, because of a small weevil, that bores into them after they are gathered and renders them unfit for stock feed. One acre of land well covered with mesquite trees often produces not less than 100 bushels of the beans per annum. As, bushel for bushel, they are quite as valuable for feeding stock as cow-peas, it will be seen that for forage purposes the mesquite tree is an important factor in this section, where there are millions of them.

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